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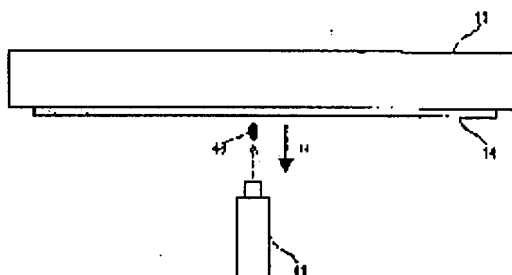
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(54) FUNCTIONAL ELEMENT SUBSTRATE, IMAGE DISPLAY DEVICE, AND
MANUFACTURING INSTALLATION OF THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To manufacture a quality functional element substrate with a simple composition in which foreign matters, such as an impurity which floats in the air, do not fall on a functional element formation section.

SOLUTION: With respect to the position relation between an injection head 11 and the functional element substrate 14 at the time of injecting the droplets 43 of a solution containing a functional material to adhere to the functional element board 14 from the injection head 11, the direction of injection is made in an opposite direction to the gravitational attraction direction G (it is injected upward) and further, at the time of adhering, is made to adhere in an almost perpendicular direction to the face of the substrate 14. That is, by arranging the functional element board 14 almost horizontally, and by injecting the droplets 43 of a solution to adhere from the underside, the fall of performance of the functional element caused by adhering of foreign matters, such as dust which floats in the air, fallen on the functional element formation section of the functional element board 14, is avoided.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the image display device using the functional component substrate formed of film formation of the high-performance material which used regurgitation equipment especially a film pattern formation manufacturing installation, and it, and its functional component substrate.

[0002]

[Description of the Prior Art] In recent years, development of the light emitting device using the organic substance as a spontaneous light type display replaced with a liquid crystal display is accelerating. Such component formation is performed by patternizing of a functional material, and, generally it is carried out by the photolithography method. For example, the approach of forming low-molecular with vacuum deposition as an organic electroluminescence (it being described as organic electroluminescence below) component using the organic substance, as shown from 913 pages of Appl.Phys.Lett.51(12) and 21 September 1987 is reported. Moreover, in the organic EL device, the approach of vapor-depositing and forming a different luminescent material over a mask on a desired pixel as a means of colorization is performed. However, in order to form a component over a large area, the approach by such vacuum membrane formation and the approach by the photolithography method also have many routing counters, and have the fault that a production cost is high.

[0003] A functional component formation with which this invention person is represented to the above technical problems by the organic EL device like **** sake, In formation and patternizing of the high-performance material film U.S. Pat. No. 3060429, With an ink jet drop grant means which is known as U.S. Pat. No. 3298030, U.S. Pat. No. 3596275, U.S. Pat. No. 3416153, U.S. Pat. No. 3747120, U.S. Pat. No. 5729257, etc. I thought that high-performance material could be stably given to a desired location with the sufficient yield by low cost, without being based on the vacuum forming-membranes method, the photolithography etching method, etc.

[0004] For example, when an organic EL device was considered as an example of a functional component, I thought that it was realizable if the constituent which made the solvent dissolve or distribute the hole injection / transport ingredient, and luminescent material which constitute such an organic EL device is made to breathe out from an ink jet head, and carries out patterning spreading on a transparent electrode substrate and pattern formation of a hole injection / transporting bed, and the luminescence material layer is carried out. However, it is necessary to change a view fundamentally [a case as paper powder is floating] like [when forming such a functional component / in the ink jet record which serious cleanliness is required of the functional component forming face, and records by making it turn the so-called ink to paper and fly, adhere and absorb].

[0005]

[Problem(s) to be Solved by the Invention] This invention was made in view of the actual condition like ****, and the 1st object is in proposing the new manufacturing installation for forming such the functional elements and a functional component substrate. Moreover, the 2nd object is to propose the

manufacturing installation for forming the quality functional elements. Furthermore, the 3rd object is to propose the manufacturing installation for forming such the functional elements in high degree of accuracy. Moreover, the 4th object is manufactured by such manufacturing installation and is to propose the functional component substrate with which the functional elements were formed in high quality and a highly precise location. Furthermore, the 5th object is to propose the image display device using the high quality and the highly precise functional component substrate which were manufactured by such manufacturing installation.

[0006]

[Means for Solving the Problem] In order to attain said object, the functional elements which emit a function by inputting a predetermined driving signal into the 1st this invention In the manufacturing installation of the functional component substrate formed by carrying out injection grant of the drop of the solution which contains high-performance material on a substrate, volatilizing the volatile constituent in this solution, and making solid content remain on said substrate The injection head which injects the solution which was arranged on the location which faces said substrate and contained high-performance material to this substrate, Have an information input means to input drop grant information into this injection head, and the forming face of said functional elements in said substrate and the solution injection-tip side of said injection head hold a fixed distance. It is constituted so that said substrate and said injection head may perform relative displacement to parallel to the forming face of said functional elements. Said injection head It is the manufacturing installation which forms said functional elements by injecting said solution in the location of a request of said substrate based on said drop grant information that it was inputted by said information input means. The physical relationship of said injection head and said substrate was mostly given to said substrate side from the perpendicular direction at the time of grant of said solution, while said solution turned to the vertical range up from the horizontal mostly and was injected and given from said injection head.

[0007] In the manufacturing installation of the functional component substrate of the 2nd above 1st, said substrate formed the gas style containing the vector component of the gravity operation direction in said substrate arrangement field while the grant side of said solution had been arranged mostly downward.

[0008] It sets [3rd] to the manufacturing installation of the functional component substrate of the above 2nd, and was made to make the rate when injecting and giving said solution from said injection head from the rate of said gas style into size.

[0009] The functional component substrate was formed [4th] by the manufacturing installation of the above 1st thru/or the 3rd one of functional component substrates.

[0010] It considered as an image display device which has the cover plate which countered the functional component substrate and this functional component substrate of the above 4th, and has been arranged [5th].

[0011]

[Embodiment of the Invention] Drawing 1 is the case where an organic EL device is considered as an example of a functional component. Here, the example given from a nozzle 1 is shown so that the solution 2 which dissolved the organic electroluminescence ingredient which colors at red, green, and blue on the electrode concerned of the ITO (indium tin oxide) transparent electrode pattern 4 divided in the shape of a mosaic and the glass substrate 5 with an obstruction 3 surrounding a transparent electrode part may be arranged in the shape of [each] a color mosaic. The presentation of a solution is as follows.

Solution constituent solvent Dodecylbenzene/dichlorobenzene (1/1, volume ratio)

Red The poly fluorene / perylene color (98/2, weight ratio)

Green The poly fluorene / coumarin color (98.5 / 1.5, weight ratio)

Blue Poly fluorene [0012] The rate to the solvent of a solid is made into 0.4% (weight/volume).

Here, after it heats it at 100 degrees C and it removes a solvent, the substrate to which such a solution was given carries out a metal mask suitable on this substrate, and vapor-deposits 2000Å of aluminum (un-illustrating), from ITO and aluminum, it pulls out lead wire and a component completes it by using aluminum as cathode, using ITO as an anode plate. Red and the component which emits light green and

blue are obtained in a configuration predetermined in applied voltage with about 15 volts. In addition, the electrode is previously formed on the substrate, injection grant of the drop of such a solution is carried out afterwards, the volatile constituent in a solution is volatilized, and component formation may be performed by making solid content remain on said substrate.

[0013] And the substrate which constituted such a component can use transparence cover plates, such as glass or plastics, as image display devices, such as a spontaneous light type organic electroluminescence display, opposite arrangement and by carrying out casing (packaging). In addition, although it is the case where an organic EL device is considered as an example of a functional component here, it is not necessarily limited to such a component and an ingredient. For example, when an electron emission component is considered, the solution containing the compound of a palladium system is used. In this case, it becomes the electron emission mold display by which packaging was carried out to this electron emission component substrate as the last gestalt by carrying out opposite arrangement of the face plate possessing a fluorescent substance. Moreover, an organic transistor etc. can be suitably manufactured as a functional component. Moreover, it is used as a solution which uses the resist ingredient for forming the obstruction 3 of the above-mentioned example etc. for this invention.

[0014] Here, by this invention, the technique of an ink jet is applied as a means to give the solution containing such high-performance material. Below, the concrete approach is explained.

[0015] Drawing 2 is drawing for explaining one example of the manufacturing installation of the functional component substrate of this invention. A discharge-head unit (injection head) and 12 among drawing 11 Carriage, The supply tube of the substrate with which 13 forms a substrate maintenance base and 14 forms a functional component, and the solution containing 15 high-performance material, A signal supply cable and 17 16 An injection head control box, For the direction scan motor of X of carriage 12, and 19, as for a computer and 21, the direction scan motor of Y of carriage 12 and 20 are [18 / a control box and 22 (22X1, 22Y1, 22X2, 22Y2)] substrate positioning / maintenance means.

[0016] Drawing 3 is the schematic diagram showing the configuration of the drop grant equipment applied to manufacture of the functional component substrate of this invention, and drawing 4 is the important section outline block diagram of the discharge-head unit of the drop grant equipment of drawing 3. Unlike the configuration of drawing 2, the configuration of drawing 3 moves a substrate 14 side, and forms the functional elements in a substrate. drawing 3 and drawing 4 -- setting -- 31 -- a head alignment controlling mechanism and 32 -- detection optical system and 33 -- an ink jet head and 34 -- a head alignment jogging device and 35 -- a control computer and 36 -- image identification scheme and 37 -- the XY direction scanner and 38 -- for ink jet head actuation and a controlling mechanism, and 41, as for a component electrode and 43, an optical axis and 42 are [a location detection device and 39 / a location amendment controlling mechanism and 40 / a drop and 44] drop impact locations.

[0017] As drop grant equipment (ink jet head 33) of the discharge-head unit 11, as long as it can carry out the quantum regurgitation of the drop of arbitration, what kind of device is sufficient, and the device of the ink jet method which can form the drop of number - number 100pl extent especially is desirable. The method currently indicated by the U.S. Pat. No. 3683212 description as an ink jet method, for example (Zoltan method), The method currently indicated by the U.S. Pat. No. 3747120 description (Stemme method), Like the method (Kyser method) currently indicated by the U.S. Pat. No. 3946398 description, for a piezo oscillating component An electric signal is impressed, this electric signal is changed into the mechanical oscillation of a piezo oscillating component, and there are some which carry out regurgitation flight of the drop from a detailed nozzle according to this mechanical oscillation, and it names generically and is usually called the drop method on demand.

[0018] As other methods, there is a method (Sweet method) currently indicated by the U.S. Pat. No. 3596275 description, the U.S. Pat. No. 3298030 description, etc. By the continuation oscillating evolution method, this generates the globule of the record liquid by which the amount of electrifications was controlled, is making between the deflecting electrodes with which the globule by which this generated amount of electrifications was controlled is hung on uniform electric field fly, records on a record member, and is usually called the continuous-flow method or the electrification control system.

[0019] Furthermore, there is a method currently indicated by JP,56-9429,B as other methods. This

makes air bubbles generate in a liquid, carries out regurgitation flight of the drop from a detailed nozzle according to the applied force of the air bubbles, and is called the thermal ink jet method or the bubble ink jet method. Thus, the method which injects a drop should just choose the method suitably if needed, although there are a drop method on demand, a continuous-flow method, a thermal ink jet method, etc. [0020] In this invention, in the manufacturing installation of a functional component substrate as shown in drawing 2, a substrate 14 adjusts that maintenance location and is decided by substrate positioning / maintenance means 22 of this equipment. Although it has simplified in drawing 2, it connects with the injection head control box 17, a computer 20, and control box 21 grade, and substrate positioning / maintenance means 22 can feed back continuously the positioning information fine adjustment displacement information, etc. the positional information of drop grant, timing, etc. while being able to tune finely to mum order in the direction of Y which intersects perpendicularly with the direction of X, and it while being contacted each side of a substrate 14. Furthermore, in the manufacturing installation of the functional component substrate of this invention, it has the revolution positioning device which is not illustrated besides the positioning device of X and the direction of Y (it is not visible since it is located under a substrate 14).

[0021] In relation to this, the configuration of the functional component substrate of this invention and the array of the functional elements formed are explained previously. Ceramic substrates, such as glass with which the functional component substrate of this invention reduced impurity contents, such as quartz glass and Na, blue plate glass, a glass substrate which made SiO₂ deposit on a front face, and an alumina, etc. are used. Moreover, various plastic plates including PET are also suitably used for the purpose of lightweight-izing or flexibility. make it any -- such a substrate is produced economically and supplied, or from the application of the functional component substrate manufactured eventually, in Si wafer etc., the configuration is different and is a rectangle (four side form of right angles). That is, the parallel and side in every direction of two sides long which constitute the rectangle configuration, and two sides wide is the substrate which makes a right angle mutually parallel and two sides wide mutually two sides long, respectively.

[0022] To the above substrates, by this invention, the functional elements formed are arranged in the shape of a matrix, and the 2-way which intersects perpendicularly mutually [this matrix] arranges the functional elements so that in parallel with the direction of the side of the lengthwise direction of this substrate, or the lateral side. Thus, the reason for arranging the functional elements in the shape of a matrix and the reason the side of a substrate in every direction is made to become the 2-way a 2-way and the matrix cross at right angles, and parallel are explained below.

[0023] As shown in drawing 2 or drawing 3, especially after the physical relationship of the solution injection-tip side of a substrate 14 and the discharge-head unit 11 is decided, by this invention, position control is not performed first. That is, the above-mentioned solution is injected, performing relative displacement of X and the direction of Y to parallel to the forming face of the functional elements, while the discharge-head unit 11 maintains a fixed distance to a substrate 14 (for example, a solution, a resist ingredient, etc. which dissolved the organic electroluminescence ingredient or the conductive ingredient). That is, this direction of X and the direction of Y are 2-ways which intersect perpendicularly mutually, and since the functional elements formed also have the parallel 2-way of that matrix-like array respectively if the longitudinal side or the horizontal side of a substrate is made to become that direction of Y or the direction of X, and parallel in case a substrate is positioned, they can perform elements formation of high degree of accuracy only by the device injected performing relative displacement. it puts in another way -- if it becomes -- a substrate configuration like this invention, and the shape of a matrix of the functional elements -- if the substrate if it is made X and the relative-displacement equipment of the 2-way of Y which arranged and intersect perpendicularly, before performing drop injection of component formation is positioned to accuracy, I hear that the matrix-like array of the highly precise functional elements is acquired, and it is.

[0024] Here, it returns and explains to the revolution positioning device like the point. As mentioned above, in this invention, the substrate before performing drop injection of component formation will be positioned to accuracy, only relative displacement of X and the direction of Y will be performed, and

other control will not be performed, but the matrix-like array of the highly precise functional elements will be acquired. Gap of the hand of cut at the time of positioning a substrate first (hand of cut [as opposed to a vertical shaft to the flat surface determined by the 2-way of X and Y]) poses a problem in that case. In order to amend gap of this hand of cut, in this invention, it has the revolution positioning device which is not illustrated as mentioned above (it is located under a substrate 14 and is not visible). If this also amends gap of a hand of cut and the side of a substrate is positioned, with the equipment of this invention, the matrix-like array of the highly precise functional elements will be acquired by the relative displacement of only X and the direction of Y.

[0025] the above -- a revolution positioning device -- substrate positioning / maintenance means 22 (22X1, 22Y1, 22X2, 22Y2) of drawing 2 -- as the device of a different thing -- having explained (it being located under a substrate 14 and not being visible) -- it is also possible to give a revolution positioning device to substrate positioning / maintenance means 22. For example, in the part contacted by the side of the substrate 14 of substrate positioning / maintenance means 22, although substrate positioning / maintenance means 22 is contacted by the side of a substrate 14 and the substrate positioning / maintenance means 22 whole can adjust a location in the direction of X, or the direction of Y, if it is made for two screws which kept their distance and were formed to move independently, include-angle adjustment is possible. In addition, it connects with the injection head control box 17, a computer 20, and control box 21 grade like the above-mentioned X, the positioning information on the direction of Y, fine adjustment displacement information, etc., and the positional information of drop grant, timing, etc. can also feed back now this revolution position control information continuously.

[0026] Next, other means of positioning of this invention and a configuration are explained. In the above-mentioned explanation, substrate positioning / maintenance means 22 explains the example which prepared the band-like pattern in the 2-way which intersects perpendicularly mutually on a substrate instead of the side of a substrate 14 here, although it is contacted by the side of a substrate 14 and the substrate positioning / maintenance means 22 whole enables it to adjust a location in the direction of X, or the direction of Y. As mentioned above, although the functional elements are arranged in the shape of a matrix and it is formed on a substrate in this invention, the band-like pattern of the above 2-ways which intersect perpendicularly mutually is formed here so that it may become the 2-way and parallel which intersect perpendicularly mutually [this matrix]. Such a pattern can be easily formed with a photofabrication technique on a substrate. Or the above patterns may not be created only for the object, but you may consider that circuit patterns, such as the component electrode 42 (refer to drawing 4), the direction wiring of X of each component, and the direction wiring of Y, are the band-like patterns of the 2-way which intersects perpendicularly mutually [this invention]. If such a band-like pattern is prepared, according to the detection optical system 32 using a CCD camera and a lens which are later mentioned by drawing 4 , pattern detection can be performed and it can feed back to positioning.

[0027] Next, position control is not performed especially after the physical relationship of the solution injection-tip side of a substrate 14 and the discharge-head unit 11 is first decided by this invention to Above X and the direction of Y, although it was a perpendicular Z direction. That is, although the solution containing high-performance material is injected performing relative displacement of X and the direction of Y while the discharge-head unit 11 maintains a fixed distance to a substrate 14, at the time of the injection, especially position control of the Z direction of the discharge-head unit 11 is not performed. The reason is a device, a control system, etc. not only become complicated, but that formation of the functional component by the drop grant to a substrate 14 will become slow, and productivity will fall remarkably if the control is performed at the time of injection.

[0028] Instead, by this invention, by raising precision, such as flatness of the equipment of the part holding the flatness of a substrate 14, or its substrate 14, and a carriage device in which relative displacement is made to perform the discharge-head unit 11 in X and the direction of Y further, Z direction control at the time of injection is not performed, but X of the discharge-head unit 11 and a substrate 14 and relative displacement of the direction of Y are performed at high speed, and productivity is raised. If an example is given, fluctuation of the substrate 14 at the time of solution grant of this invention (at the time of injection) and the distance of the solution injection-tip side of the

discharge-head unit 11 is pressed down by 5mm or less (when the sizes of a substrate 14 are more than 200mmx200mm and less than [4000mmx4000mm]).

[0029] In addition, what is necessary is not to necessarily level the flat surface decided by the 2-way of X and the direction of Y, when a substrate 14 is small (for example, when it to be less than [500mmx500mm]), and just to make it become the physical relationship of arrangement of the most efficient substrate 14 for the equipment, although the equipment configuration of the flat surface usually decided by the 2-way of X and the direction of Y is carried out so that it may be maintained by the horizontal (it is a vertical field to the direction of a vertical).

[0030] Next, although other examples of this invention are explained, this invention is not limited to these examples. In case drawing 3 performs relative displacement of the discharge-head unit 11 and a substrate (functional component substrate) 14 unlike the case of drawing 2, it is an example to which the functional component substrate 14 side is moved. Drawing 4 is the outline block diagram having expanded and shown the discharge-head unit of the equipment of drawing 3. First, in drawing 3, 37 is the XY direction scanner and the functional component substrate 14 is laid on it. The functional component on a substrate 14 is the same configuration as the thing of drawing 1, and consists of the glass substrate 5 (it is equivalent to the functional component substrate 14), an obstruction 3, and an ITO transparent electrode 4 like the configuration shown in drawing 1 as a single component. The discharge-head unit 11 which gives a drop is located above this functional component substrate 14. At this example, the discharge-head unit 11 is immobilization and relative displacement of the discharge-head unit 11 and the functional component substrate 14 is realized because the functional component substrate 14 moves to the location of arbitration according to the XY direction scanner 37.

[0031] Next, drawing 4 explains the configuration of the discharge-head unit 11. In drawing 4, 32 is detection optical system which incorporates the image information on a substrate 14, it approaches the ink jet head 33 which makes a drop 43 breathe out, and it is arranged so that the optical axis 41 of the detection optical system 32 and a focal location, and the impact location 44 of the drop 43 by the ink jet head 33 may be in agreement. In this case, the head alignment jogging device 34 and the head alignment controlling mechanism 31 can adjust now the physical relationship of the detection optical system 32 and the ink jet head 33 which are shown in drawing 3 to a precision. Moreover, the CCD camera and the lens are used for the detection optical system 32.

[0032] In drawing 3, 36 has the function which computes the center-of-gravity location of the specific contrast part which was the image identification scheme which identifies the image information incorporated by the detection optical system 32, made contrast of an image binary and made it binary. Specifically, the high-degree-of-accuracy image recognition equipment by KEYENCE CORP. and VX-4210 can be used. A means to give the positional information on the functional component substrate 14 to the image information obtained by this is the location detection device 38. Length measuring machines, such as a linear encoder prepared in the XY direction scanner 37, can be used for this. Moreover, based on such image information and the positional information on the functional component substrate 14, the location amendment controlling mechanism 39 performs location amendment, and amendment is added to a motion of the XY direction scanner 37 according to this device. Moreover, the ink jet head 33 drives and a drop is given by ink jet head actuation and the controlling mechanism 40 on the functional component substrate 14. Centralized control of each controlling mechanism described until now is carried out by computer 35 for control.

[0033] In addition, although the discharge-head unit 11 is immobilization and relative displacement of the discharge-head unit 11 and the functional component substrate 14 is realized by the above explanation because the functional component substrate 14 moves to the location of arbitration according to the XY direction scanner 37, as shown in drawing 2, it cannot be overemphasized that it is good also as a configuration which considers the functional component substrate 14 as immobilization, and the discharge-head unit 11 scans in the XY direction. It is better to have considered the functional component substrate 14 as immobilization like the latter, and to consider as the configuration which it is made to scan to the 2-way of X and Y Y and the discharge-head unit 11 cross at right angles, and is made to give the drop of a solution to such a 2-way that intersects perpendicularly one by one, when

applying to a fabrication of the large-sized substrate beyond about [200mmx200mm] medium size substrate -2000mmx2000mm or it especially.

[0034] Moreover, conversely, a light plastic plate is used and it is also considered that it is made to perform [the size or] paper conveyance of an ink jet printer in the case of an about [200mmx200mm-400mmx400mm] medium size substrate. That is, the discharge-head unit 11 carried in carriage 12 is scanned only in the direction of X (or only in case of the direction of Y), and a substrate is conveyed in the direction (or the direction of X) of Y. In that case, productivity improves remarkably.

[0035] When the size of a substrate 14 is or less about 200mmx200mm The discharge-head unit for drop grant is considered as the RAJIAREI MARUCHINOZURU type which can cover the range of 200mm. Although it is also possible to make the relative displacement only of for example, the direction of X carry out only in the one direction, and to carry it out to it and mass production nature can also be made high, without performing relative displacement of a discharge-head unit and a substrate to the 2-way (the direction of X, the direction of Y) which intersects perpendicularly When substrate size is more than 200mmx200mm It is difficult to realize in technical/cost to manufacture the discharge-head unit of the RAJIAREI MARUCHINOZURU type which can cover such range of 200mm. It is better to consider as the configuration which it is made to scan to the 2-way of X and Y Y and the discharge-head unit 11 cross at right angles like this invention, and is made to give the drop of a solution to such a 2-way that intersects perpendicularly one by one.

[0036] Even if it is the case where a thing smaller than 200mmx200mm is especially manufactured as a final substrate, in carrying out by taking more than one and manufacturing from a big substrate Since 400mmx400mm-2000mmx2000mm or the thing beyond it will be used for the substrate of the origin of it It is better to consider as the configuration which it is made to scan to the 2-way of X and Y Y and the discharge-head unit 11 cross at right angles, and is made to give the drop of a solution to such a 2-way that intersects perpendicularly one by one.

[0037] Ingredients, such as a meltable low-molecular system organic electroluminescence ingredient, a giant-molecule system organic electroluminescence ingredient, and a polyvinyl carbazole, can be used for for example, the polyphenylene vinylene system (poly PARAFENIRIREN vinylene system derivative), the polyphenylene system derivative, and the other benzene derivatives other than an organic electroluminescence ingredient which were previously stated to the ingredient of a drop 43. As an example of an organic electroluminescence ingredient, rubrene, perylene, 9, 10-diphenyl anthracene, a tetra-phenyl butadiene, the Nile red, a coumarin 6, Quinacridone, the poly thiophene derivative, etc. are mentioned. Moreover, it is used as the electronic transportability which is a circumference ingredient in an organic electroluminescence display, and a functional material with which a hole transportability ingredient also manufactures the functional component of this invention.

[0038] If it considers as the functional material which manufactures other functional components of this invention, it is the precursor of the silicon glass of the interlayer insulation film used abundantly at a semi-conductor etc., or a silica glass formation ingredient can be mentioned. As this precursor, polysilazane (for example, TONEN make), an organic SOG ingredient, etc. are mentioned. Moreover, an organometallic compound may be used.

[0039] Furthermore, the charge of light filter lumber is mentioned as other examples. Specifically, sublimation colors, such as the SUMIKA red B (a trade name, Sumitomo Chemical color), Kaya Ron fast-yellow-G L (a trade name, Nippon Kayaku color), and the diamond SERINFUASUTOBU lily yarn blue B (a trade name, Mitsubishi Kasei color), etc. can be used.

[0040] In the solution constituent of this invention, it is desirable that the boiling point of a benzene derivative is 150 degrees C or more. As an example of such a solvent, O-dichlorobenzene, m-dichlorobenzene, 1 and 2, 3-trichlorobenzene, O-chloro toluene, p-chloro toluene, 1-chloronaphthalene, a bromobenzene, O-dibromo benzene, 1-dibromo naphthalene, etc. are mentioned. By using these solvents, since the vaporization of a solvent can be prevented, it is suitable. The solubility to an aromatic compound is greatly suitable for these solvents. Moreover, it is desirable that the solution constituent dodecylbenzene of this invention is included. As dodecylbenzene, n-dodecylbenzene single is sufficient, and the mixture of an isomer can also be used.

[0041] this solvent -- the property of 300 degrees C or more of boiling points, and 6 or more (20 degrees C) cp of viscosity -- having -- this solvent single -- even when -- although it is easy to be natural, by adding to other solvents, the vaporization of a solvent can be prevented effectively and it is suitable. Moreover, among the above-mentioned solvents, except dodecylbenzene, since viscosity can also be adjusted by adding this solvent since viscosity is comparatively small, it is dramatically suitable. According to this invention, after supplying on a substrate a solution constituent which was mentioned above by the regurgitation with regurgitation equipment, the functional film forming method which processes and film-izes a substrate at an elevated temperature from temperature at the time of the regurgitation is offered. A discharge temperature is a room temperature and it is desirable after the regurgitation to heat a substrate. By carrying out such processing, at the time of the regurgitation, the contents which deposited by vaporization of a solvent and lowering of temperature are remelted, and homogeneity and the homogeneous functional film can be obtained. In the method of producing the above-mentioned functional film, in case a regurgitation constituent is processed after supplying on a substrate and a substrate is processed from temperature to an elevated temperature with regurgitation equipment at the time of the regurgitation, heating pressurizing is desirable. Thus, by processing, the vaporization of the solvent at the time of heating can be delayed, and remelting of contents is promoted further. Consequently, homogeneity and the homogeneous functional film can be obtained. Moreover, in the method of producing the above-mentioned functional film, it is desirable to decompress said substrate promptly after high temperature processing, and to remove a solvent. Thus, by processing, the phase separation of the contents at the time of concentration of a solvent can be prevented.

[0042] Also in which ingredient or functional component, this invention volatilizes the volatile constituent in this solution, component formation is performed by making solid content remain on said substrate, this solid generates the function of each component, and a solvent (volatile constituent) is a means (vehicle) for carrying out injection grant of the drop by the ink jet principle.

[0043] In case the discharge-head unit (injection head) 11 gives the above-mentioned drop 43 to the desired component polar zone The location which should be given is measured by the detection optical system 32 and the image identification scheme 36. The measurement data, The delivery side of the discharge-head unit (injection head) 11, and the distance of the functional component substrate 14, An amendment coordinate is generated based on the passing speed of carriage, and a drop is given, making the discharge-head unit (injection head) 11 move as this amendment coordinate in X and the direction of Y in functional component substrate 14 front face. As detection optical system 32, as image identification scheme 36, it is a commercial thing and what asks an image for the center-of-gravity location of binary-ized *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne. can be used using what combined the CCD camera etc. and the lens.

[0044] As mentioned above, in this invention, the discharge-head unit (injection head) 11 injects a solution, performing carriage migration to parallel in the direction of X (or the direction of Y or the 2-way of X and Y) maintaining a fixed distance to the functional component substrate 14, and forms the functional elements. In that case, if it injects by stopping carriage migration whenever it injects the solution for forming each component, it is possible to form the highly precise elements. However, it is made to inject a solution, since productivity falls remarkably one by one as mentioned above, without stopping the carriage migration.

[0045] Next, other descriptions of this invention are explained. In this invention, carry out air flight of the drop by fluid injection, the solution which contains high-performance material as mentioned above although the functional component section is formed is made to adhere to a substrate, and it forms. Apparently, this principle itself is similar to the usual ink jet printer, and if it is applied as it is, it seems to be satisfactory in any way. However, the operating environment of the ink jet printer which injects ink on paper and is recorded on it is an environment which the paper powder generated from paper, the foreign matter of the versatility which floats, for example in fines, such as a calcium carbonate, and the further usual air which has carried out the coat to the front face of paper are dancing continuously, and they fall and adhere to the recording surface-ed on space according to a gravity operation. Unless it is mm order or a thing beyond it, as ink jet record, such a foreign matter etc. does not affect image quality

degradation, and can almost disregard it.

[0046] However, if it is in the functional component section in which the foreign matter is formed in forming a functional component like this invention, the component engine performance will produce the nonconformity of stopping falling or functioning remarkably. This point is the big difference between an ink jet printer and this invention. the time of the drop 43 of the solution containing high-performance material being injected and given from the injection head 11 in the physical relationship of the injection head 11 and the functional component substrate 14, as this invention shows to drawing 5 in view of this point -- the gravity operation direction G -- receiving -- an opposite direction -- carrying out (it injecting upward) -- he is trying to give mostly a substrate side from a perpendicular direction at the time of grant That is, the functional component substrate 14 is arranged at a cheek horizontal, and it is made to perform injection of the drop 43 of a solution, and grant from the bottom. By carrying out like this, it falls in the functional component formation section of the functional component substrate 14, and foreign matters, such as dust which floats in air to the above-mentioned, adhered, and have avoided causing the degradation of the functional component formed.

[0047] In addition, drawing 1 - drawing 4 are used as drawing for explaining a drop injection principle, and although considered as drawing injected downward like the conventional ink jet printer, by this invention, it refuses actually that these are all the configurations (it injects upward like drawing 5) of the reverse sense. Moreover, although drawing 5 showed that the functional component substrate 14 was arranged at a cheek horizontal, and injection of a drop 43 and grant were vertically performed towards the upper part from the bottom, the functional component substrate 14 does not need to be arranged horizontally thoroughly. Since it is good if the foreign matter which is floating does not fall to the functional component formation section of a substrate according to a gravity operation in short, the forming face has just turned to the lower part. For example, like drawing 6 , even if it is the configuration of having made the functional component substrate 14 inclining, foreign matters, such as dust which floats in air, fall, and do not necessarily adhere to the functional component formation section of a functional component substrate, and such a configuration also enters under the category of this invention.

[0048] Next, the description of further others of this invention is explained. In order to obtain the effectiveness more, it was made for foreign matters, such as dust which floats in such air positively, not to adhere here, although the component forming face was placed upside down in the above-mentioned explanation so that foreign matters, such as dust which floats in air, fell and might not adhere to the functional component formation section of a functional component substrate. Drawing 7 was drawing showing one of them, the air attraction field 50 is established in the lower part of the field where the functional component substrate 14 and the injection head 11 are arranged, and the gas style Air containing the vector component of the gravity operation direction G was formed in the field to which the functional component substrate 14 and the injection head 11 are arranged here. Here, the air attraction field 50 can be formed by transferring a fan (un-illustrating), can lengthen Air Air from the attraction hole 51, and can form the gas style containing the vector component of the gravity operation direction G in the field to which the functional component substrate 14 and the injection head 11 are arranged. In addition, although later mentioned as a rate of flow of the gas style formed here, it is good to consider as 0.3 - 2 m/s extent.

[0049] Moreover, you may make it pass positively so that the vector component of the gravity operation direction may be included to the field to which the functional component substrate 14 and the injection head 11 are arranged as other examples in the nitrogen gas defecated with the filter. make it any -- by generating such a gas style positively, rather than the case which only placed the component forming face of a functional component substrate upside down, it becomes possible to prevent more effectively adhesion of foreign matters, such as dust which floats in air, and a more reliable functional component substrate can be manufactured.

[0050] In addition, in this invention, since the above gas styles have injection of the drop of this invention, and the velocity-vector component of a direction and an opposite direction which performs grant, they do not bar injection of a drop, and grant. In this invention, the relation between the rate of

flow of such a gas style and the rate of injection of a drop and grant was investigated in view of this point. Below, the result is shown. This example draws in by the fan from the bottom like drawing 7, and the gas style Air containing the vector component of the gravity operation direction is formed in the field to which the functional component substrate 14 and the injection head 11 are arranged. While changing a fan's rotational frequency and changing the rate of the gas style formed, injection of a drop and the rate of grant are changed, good drop adhesion can be performed on the functional component substrate 14, and it investigates whether it functions as a functional component.

[0051] The used substrate changed into the mixed solution of O-dichlorobenzene / dodecylbenzene the solution which mixed 0.1 percent by weights of poly hexyloxy phenylenevinylene by the ink jet principle, and gave jet velocity to the glass substrate with an ITO transparent electrode. Distance between an injection head nozzle and a substrate was set to 3mm. The diameter of a nozzle was $\phi 23$ micrometer, in order to change jet velocity, the input voltage to a piezo-electric element was changed from 18V to 30V, an ink jet head is a drop on-demand mold ink jet head using a piezo-electric element, and drive frequency could be 9.6kHz. in addition, then, although the input voltage to a piezo-electric element could be changed and jet velocity could be changed with the drop on-demand mold ink jet head using such a piezo-electric element, since the mass of an injection drop also changed to coincidence, control an actuation wave (lengthening -- also striking -- it included -- starting -- a wave and a fall wave), it is made for the mass of an injection drop to always become about 1 law (for it to have been made 5pl), and only jet velocity was changed into it.

[0052] Moreover, the configuration of the drop at the time of drop flight was separately injected and observed on the same conditions as component formation, and the actuation wave was made to control and inject so that it may become a drop with the configuration almost round just before adhering to a substrate side (now the example of this invention 3mm). In addition, the shape of a completely round ball was not acquired, but it was extended in the flight direction, and even if pillar-shaped, the actuation wave was controlled and it was made less than 3 times [of the diameter] die length. Moreover, actuation conditions (actuation wave) without two or more minute drops were chosen as flight drop back at that time. Then, aluminum was vapor-deposited on this and component formation was performed. When lead wire was pulled out, and the electrical potential difference of 10V was impressed by using aluminum as cathode from ITO and aluminum, having used ITO as the anode plate, the result as shown in a table 1 was obtained.

[0053] Here, as for O, drop grant is performed for the component formation situation on a substrate to the field (polar zone) of an aim, and, as for the thing and x from which, as for **, the location shifted [there] selectively, a location shifts from there. As for O, the component engine performance emits light in orange in a predetermined configuration, and x does not emit light or emits light selectively (as a component, a real activity is impossible).

[0054]

[A table 1]

実験 No.	気体流速度 Vf(m/s)	液滴噴射速度 Vj(m/s)	基板上の素子形成状況	素子性能
1	0.3	3	○	○
2	0.3	5	○	○
3	0.3	7	○	○
4	0.3	12	○	○
5	0.8	3	○	○
6	0.8	5	○	○
7	0.8	7	○	○
8	0.8	12	○	○
9	2	3	△	×
10	2	5	○	○
11	2	7	○	○
12	2	12	○	○
13	5	3	×	×
14	5	5	×	×
15	5	7	△	×
16	5	12	○	○

[0055] The above result showed that good component formation could not be performed, when drop jet velocity was not made into size from a gas style rate. moreover, the difference -- 1-2m/[in s] -- being useless (9 experiment No. 15) -- when it was made 3 or more m/s, it turned out that good component formation can be performed. furthermore, a gas style rate -- large -- carrying out -- passing (experiment No.13-16) -- since drop jet velocity also had to be made quick according to it and the selection width of face of drop jet velocity became narrow, as for the gas style rate, the good thing was also understood that it makes it 0.3 - 2 m/s extent.

[0056] In addition, although the example which carries out injection grant of the drop into an obstruction 3 by drawing 1 is shown, in forming the functional elements in the above-mentioned experiment, there is no obstruction 3 as shown in drawing 1, and it refuses to form direct electrode pattern formation and the functional component by drop grant to the substrate on a plate. Moreover, carrying out injection grant so that it may hit [as opposed to / actually / a substrate] almost vertically, although considered as drawing where the drop is flying aslant in this way in order that this may illustrate the detection optical system 32 and the ink jet head 33 collectively, although drawing injected aslant [a drop] to a substrate side by drawing 4 was shown also refuses.

[0057] Moreover, although explanation is given by the case where a light emitting device is formed as a functional component, the formed light emitting device substrate is utilized as a display unit opposite arrangement and by carrying out casing (packaging) in transparence cover plates, such as glass or plastics, after that. Moreover, it not only applies to a display unit, but an organic transistor etc. is suitably manufactured as a functional component using the technique of this invention. Moreover, by using a resist ingredient etc. as an injection solution, it is applied also when forming the three-dimensional structure object by the resist pattern or the resist ingredient, and the film pattern or three-dimensional structure object of a resin ingredient [like such a resist ingredient] whose functional component as used in the field of this invention is therefore formed is also included.

[0058]

[Effect of the Invention] The functional elements which emit a function by inputting the effectiveness predetermined driving signal corresponding to claim 1 In the manufacturing installation of the functional component substrate formed by carrying out injection grant of the drop of the solution which contains high-performance material on a substrate, volatilizing the volatile constituent in this solution, and making solid content remain on said substrate The injection head which injects the solution which was arranged on the location which faces said substrate and contained high-performance material to this

substrate, Have an information input means to input drop grant information into this injection head, and the forming face of said functional elements in said substrate and the solution injection-tip side of said injection head hold a fixed distance. It is constituted so that said substrate and said injection head may perform relative displacement to parallel to the forming face of said functional elements. Said injection head It is the manufacturing installation which forms said functional elements by injecting said solution in the location of a request of said substrate based on said drop grant information that it was inputted by said information input means. While said solution turns to the vertical range up from a horizontal mostly and is injected and given from said injection head, the physical relationship of said injection head and said substrate Since it was made to give mostly said substrate side from a perpendicular direction at the time of grant of said solution, foreign matters, such as an impurity which floats in the air, do not fall to the functional elements formation section, and the quality functional component substrate could be manufactured with the easy configuration.

[0059] since said substrate formed the gas style containing the vector component of the gravity operation direction in said substrate arrangement field while the grant side of said solution had been arranged downward mostly, it can eliminate positively foreign matters, such as an impurity which float in the air, from the functional elements formation section, and a substrate could be formed the quality functional elements by the easy configuration in the manufacturing installation of the effectiveness functionality component substrate corresponding to a claim 2.

[0060] Since the rate when setting to the manufacturing installation of the effectiveness functionality component substrate corresponding to claim 3, and injecting and giving said solution from said injection head was made into size from the rate of said gas style, though it was an easy configuration, solution injection was stabilized, and the impact location precision of the drop can be high, and could form such the functional elements in high degree of accuracy.

[0061] Since it was the functional component substrate which had the functional elements manufactured by the manufacturing installation by effectiveness this invention corresponding to claim 4 formed, the functional component substrate which the yield is low cost highly even if it is a large-sized substrate, and formed the functional elements of high degree of accuracy could be realized.

[0062] Since the functional component substrate formed in the effectiveness high quality and high degree of accuracy corresponding to claim 5 was used for the image display device, a high-definition image display device came to be obtained.

[Translation done.]